

इंटरनेट

मानक

Disclosure to Promote the Right To Information

Whereas the Parliament of India has set out to provide a practical regime of right to information for citizens to secure access to information under the control of public authorities, in order to promote transparency and accountability in the working of every public authority, and whereas the attached publication of the Bureau of Indian Standards is of particular interest to the public, particularly disadvantaged communities and those engaged in the pursuit of education and knowledge, the attached public safety standard is made available to promote the timely dissemination of this information in an accurate manner to the public.

“जानने का अधिकार, जीने का अधिकार”

Mazdoor Kisan Shakti Sangathan

“The Right to Information, The Right to Live”

“पुराने को छोड़ नये के तरफ”

Jawaharlal Nehru

“Step Out From the Old to the New”

IS 7567 (1993): Automatic circuit reclosers [ETD 8: High Voltage Switchgear and Controlgear]



“ज्ञान से एक नये भारत का निर्माण”

Satyanarayan Gangaram Pitroda

“Invent a New India Using Knowledge”



“ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है”

Bhartrhari—Nitiśatakam

“Knowledge is such a treasure which cannot be stolen”

BLANK PAGE



भारतीय मानक

पुनः बन्द होने वाले स्वचालित सर्किट की विशिष्टि

(दूसरा पुनरीक्षण)

Indian Standard

**AUTOMATIC CIRCUIT RECLOSERS—
SPECIFICATION**

(Second Revision)

UDC 621.316.57.064.22

© BIS 1993

BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

FOREWORD

This Indian Standard (Second Revision) was adopted by the Bureau of Indian Standards, after the draft was finalized by High Voltage Switchgear and Controlgear Sectional Committee had been approved by the Electrotechnical Division Council.

The standard was first published in 1975 and was revised in 1982. The second revision has been undertaken to increase the maximum rated voltage from 12 kV to 36 kV and to update the contents with particular reference to rural overhead line distribution systems where this type of automatic circuit reclosers are widely employed in our country.

The Indian Standards which are necessary adjuncts to this standard are given in 2.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

AUTOMATIC CIRCUIT RECLOSERS — SPECIFICATION

(Second Revision)

1 SCOPE

1.1 This standard covers the requirements for overhead line pole mounted or frame mounted single phase and three phase ac automatic circuit reclosers (thereafter called auto-reclosers) for rated voltage above 1 kV but up to and including 36 kV intended for outdoor use. Vacuum or SF₆ is the interruption medium considered:

2 REFERENCES

2.1 The following Indian Standards are necessary adjuncts to this standard:

<i>IS No.</i>	<i>Title</i>
2 : 1960	Rules for rounded off numerical values (<i>revised</i>)
1885 (Part 17) : 1979	Electrotechnical vocabulary: Part 17 Switchgear and controlgear (<i>first revision</i>)
1893 : 1984	Criteria for earthquake resistant design of structures (<i>fourth revision</i>)
2071 (Part 1) : 1974	Methods of high voltage testing : Part 1 General definitions and test requirements (<i>first revision</i>)
5613 (Part 1/Sec 1) : 1985	Code of practice for design, insulation and maintenance of overhead power lines: Part 1 Lines up to and including 11 kV, Section 1 Design (<i>first revision</i>)
9676 : 1980	Reference ambient temperature for electrical equipment
12360 : 1988	Voltage bands for electrical installations including preferred voltages and frequency
13118 : 1991	General requirements for circuit breakers for voltages above 1 000 V

3 TERMINOLOGY

3.0 For the purpose of this standard, relevant definitions in IS 1885 (Part 17) : 1979 and

IS 13118 : 1991 in addition to those below shall apply.

3.1 Auto Recloser

3.1.1 An auto recloser is a switching device with the necessary intelligence to sense over-currents to time and interrupt fault currents and if selected to do so, to reclose automatically, thus restoring supply to an overhead line. If the fault persists, then the autorecloser locks out after a preset number of operations, thus isolating the faulty line from the system.

3.1.2 Most short circuit faults occurring on overhead lines are transient in nature and leave no permanent damage when they are cleared. By suitably setting the recloser to reclose after a short dead time, supply can be restored automatically.

3.2 Unit Operation (of a Recloser)

3.2.1 An interrupting operation followed by a closing operation. The final interruption is also considered one unit operation (*see Fig. 1*).

3.3 Non-automatic Tripping (Non-automatic Opening)

The opening of an auto recloser only in response to an act of an operator.

3.4 Tripping Mechanism

An electrically or mechanically operated device which releases the holding means and permits the contact of the auto recloser to open. The release can be either shunt trip release or series trip release.

3.4.1 Shunt Release

The release energized by the sealed voltage source at the time of electrical tripping.

3.4.2 Series Release

The release energized by the over current flowing through the auto recloser.

3.5 Lockout Feature

The feature which locks the contacts in open position following the completion of the preset sequence of operations.

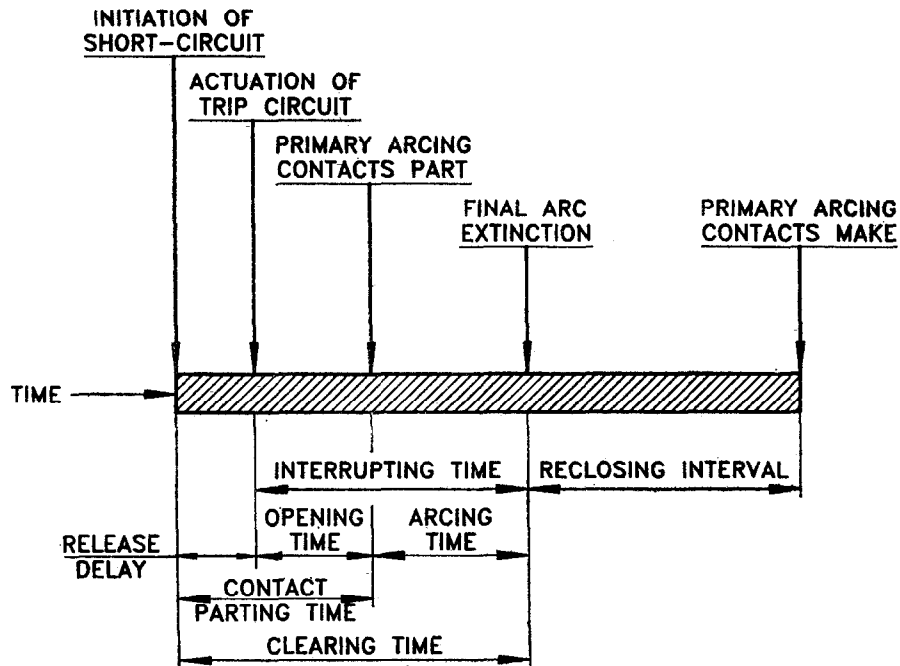


FIG. 1 UNIT OPERATION

3.6 Performance Characteristics

The limits of various parameters within which an equipment is to perform satisfactory under specified operating conditions as defined under Table 3 of this specification.

3.7 Control Unit

A control module fitted as an integral part of auto recloser and/or independently mounted, used for operating under normal and abnormal condition with programmable protective features.

3.8 Reclosing Time

The interval of time between the end of the arcing time and instant when the contacts touch in all poles during the next reclosing operation.

3.9 Reclaim Time

The time following a successful closing operation, measured from the instant the auto reclose relay closing contact make, which must elapse before the auto reclose relay will initiate a reclosing sequence in the event of a further fault incident.

4 NORMAL SERVICE CONDITIONS

4.1 Auto-reclosers conforming to this standard are intended for use under the service conditions given below:

- a) Ambient Air Temperature — The reference ambient temperature is 40°C.

NOTES

1 The reference ambient temperature assumed for the purpose of this specification are:

- i) Maximum ambient air temperature 45°C
- ii) Maximum daily average ambient air temperature 35°C
- iii) Maximum yearly average ambient air temperature 30°C
- iv) Minimum ambient air temperature -5°C

2 The manufacturer should be consulted if an auto-recloser is to be located where the temperature may fall outside the stated limits.

3 The values of reference ambient temperature assumed for the purposes of this standard are based on meteorological data in the country collected over the past several years. For the information of the users of Indian Standards on the subject of electrotechnology, details of the data collected and the basis of the assumptions made/conclusions drawn be had from IS 9676 : 1980.

- b) The altitude does not exceed 1 000 m. For installation at an altitude above 1 000 m, the manufacturer should be consulted.
- c) The ambient air is not materially polluted by dust, smoke, corrosive or flammable gases and vapours, or salts. For operation under conditions of substantial pollution, see IS 13118 : 1991.
- d) The ice-coating does not exceed 5 kgf/m². If an auto-recloser is to be located where abnormally severe conditions of ice and snow are expected, agreement should be reached between the manufacturer and the user.

- e) The wind pressure does not exceed 700 N/m^2 . Guidance on basic maximum wind pressure in various parts of India can be had from IS 5613 (Part 1/Sec 1) : 1985.
- f) Agreement should be reached between the manufacturer and the user in cases where earth tremors may be expected. Guidance on seismic zones in India can be drawn from IS 1893 : 1984.

5 RATING

5.1 Rated Characteristics

The characteristics of an autorecloser including the operating devices and integral equipment that shall be used to determine its rating are the following:

- Rated voltage,
- Rated insulation level,
- Rated frequency,
- Rated normal current,
- Rated minimum tripping voltage (for shunt release),
- Rated minimum tripping current (for series release),
- Rated short circuit breaking current,
- Rated short circuit making current,
- Rated short time current, and
- Rated operating duty.

5.2 Rated Voltage

5.2.1 The rated voltage of an autorecloser indicates the upper limit of the highest voltage of system (line-to-line) for which the equipment is intended (*see* IS 12360 : 1988). The rated voltage for the purpose of this standard shall be selected from the following values:

12 and 36 kV

5.2.2 Variations in the Rated Voltage

These shall be as per the provisions of IS 12360 : 1988 as applicable to system voltages of 11 kV and 33 kV.

5.3 Rated Insulation Level

The rated insulation level of an auto recloser shall be selected from Table 1. The withstand values specified in Table 1 refer to the standard reference atmosphere conditions specified in IS 2071 (Part 1) : 1974.

Table 1 Rated Insulation Levels
(*Clauses 5.3, 8.3 and 9.1*)

Rated Voltage	Rated Lightning Impulse Withstand Voltage	Rated Dry Power Frequency Withstand Voltage (1 Min)	Rated Wet Power Frequency Withstand Voltage (1 Min)
(1) kV (rms)	(2) kV (Peak)	(3) kV (rms)	(4) kV (rms)
12	75	28	28
36	170	70	70

5.4 Rated Frequency

The rated frequency of the auto-recloser shall be 50 Hz. Variation in frequency should be within ± 5 percent.

5.5 Rated Normal Current

5.5.1 The rated normal current of an auto-recloser shall be selected from the following:

100, 200 and 400 amperes

5.5.2 The auto-recloser shall be capable of carrying its rated normal current with the temperature rise of the various parts not exceeding the values given in IS 13118 : 1991.

5.6 Tripping Release

The auto-recloser shall have either a shunt release or a series release.

5.6.1 The minimum tripping voltage for shunt trip reclosers is variable and has no relation to the rated continuous current at which the auto-recloser will operate satisfactorily and shall be specified by the manufacturer.

5.6.2 Rated minimum tripping current for series release shall be twice the continuous current setting with a tolerance of ± 10 percent.

5.7 Rated Short Circuit Breaking Current

The relevant provisions of IS 13118 : 1991 shall apply. The rms value of the ac component of the rated short circuit breaking current shall be selected from the following values:

2, 2.5, 3.15, 4, 5, 6.3, 8, 10, 12.5 kA

(Ratings given in bold letters that is, 4, 6.3 and 12.5 kA shall be preferred).

The auto-recloser shall be capable of breaking any short circuit current up to its rated short circuit breaking current containing any ac component up to the rated values. The percentage dc component shall be derived from the X/R ratio given in Table 3.

5.8 Rated Transient Recovery Voltage for Terminal Faults

The provisions of IS 13118 : 1991 shall apply.

The standard values of rated recovery voltage for auto-reclosers shall be as given in IS 13118 : 1991 as applicable for 90-100 percent test duty as per Table 2.

5.9 Rated Symmetrical Interruption Current

The rated symmetrical interrupting currents of reclosers shall be as given in Table 3 except as limited by the series coil or minimum trip settings.

5.9.1 The rated symmetrical breaking current

shall be based on the capability of the reclosers to interrupt the corresponding symmetrical current in circuits having X/R values and with a normal frequency recovery voltage equal to the rated maximum voltage.

5.9.2 The rms value of asymmetrical fault current, at any time after initiation of the fault, is dependent upon the instantaneous voltage existing at the moment the fault is initiated and upon the decrement of the direct current component which is determined by the X/R value

Table 2 Standard Values of Rated Transient Recovery Voltage Rated Voltages Up to and Including 36 kV

(Clause 5.8)

Representation by Two Parameters — First-Pole-to-Clear Factor 1.5

Rated Voltage	TRV Peak Value	Time Co-ordinate	Time Delay	Voltage Co-ordinate	Time Co-ordinate	Rate of Rise
U	u_c	t_3	t_d	u	t	u_c/t_3
(1)	(2)	(3)	(4)	(5)	(6)	(7)
kV	kV	μs	μs	kV	μs	kV/ μs
12	20.6	60	9.0	6.9	29	0.345
36	62	108	16.2	20.6	52	0.57
$u_c = 1.4 \times 1.5 \sqrt{2/3} U$						
$u = 1/3 u_c$						
$t_d = 0.15 t_3$ for $U < 72.5$ kV						
$t_d = 0.05 t_3$ for $U = 72.5$ kV						

Table 3 Rated Operating Duty

(Clauses 5.9, 5.11.1 and 8.6)

Current Rating (A)			*Standard Operating Duty						
Rated Voltage kV (rms)	Continuous 50 Hz	Short Circuit Breaking Current at Rated Voltage	Percentage of Rated Short Circuit Breaking Current						Total No. of Operations
			15-20		45-50		90-100		
			Min X/R	No. of Unit Opera- tion	Min X/R	No. of Unit Opera- tion	Min X/R	No. of Unit Opera- tion	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(Single Phase Reclosers)									
12	Up to 200	2 000	2	52	5	68	10	18	138
(Three Phase Reclosers)									
12	Up to 400	2 000	2	52	5	68	10	18	138
		2 500	2	50	6	64	12	17	131
		3 200							
		4 000							
		5 000	3	48	7	60	14	16	124
		6 300							
		8 000							
		10 000	4	44	8	56	15	16	116
		12 500							
36	Up to 400	2 000	2	52	5	68	10	18	138
		2 500	2	50	6	64	12	17	131
		3 200							
		4 000							
		5 000	3	48	7	60	14	16	124
		6 300							
		8 000							
		10 000	4	44	8	56	15	16	116
		12 500							

*These are performance characteristics specified as test requirements in this standard.

NOTE — The standard operating duty represents half life as measured by contact erosion. Refer to the manufacturer's method for determining permissible contact erosion.

of the circuit. The following multiplying factors shall be used to obtain the maximum rms value of asymmetrical current at one-half cycle corresponding to the rated symmetrical interrupting current.

X/R	Multiplying Factor
8	1.39
10	1.44
12	1.48
14	1.51

NOTE — X/R is the ratio of inductive reactance to resistance of a circuit at rated frequency. X_1/R_1 is to be used for three phase faults and $\frac{2X_1 + X_0}{2R_1 + R_0}$ is to be used for phase-to-ground faults.

5.10 Rated Short Time Current

The rated short-time current shall be expressed in terms of one second rating and the value shall be equal to and not greater than the rated short-circuit breaking current as specified in 5.7 (if higher duration is desired, it shall be 3 seconds).

5.11 Rated Operating Duty

5.11.1 The rated operating duty of an auto-recloser is as shown in Table 3.

5.11.2 Rated Operating Sequence

The rated operating sequence of an auto-recloser shall be as follows:

O - t - CO - t - CO - t - CO - LOCK OUT
where

t = reclosing time, which shall be adjustable.

6 DESIGN AND CONSTRUCTION

6.1 For the purpose of this standard, the provisions of IS 13118: 1991 shall apply wherever applicable.

7 MARKING

7.1 Each auto-recloser shall be provided with a name plate or plates legibly and indelibly marked with at least the following information:

- Name of the manufacturer,
- Type, designation and serial number,
- Rated voltage and current,
- Rated frequency,
- Number of poles,
- Rated short-circuit breaking current,
- Rated making capacity,
- Rated short time current and its duration, and
- Weight.

NOTE — The word rated need not appear on the name plate; recognized abbreviations may be used to express the above quantities.

8 TYPE TESTS

8.0 The type tests set out in this standard are for the purpose of proving the characteristics of circuit-breakers, their operating devices and auxiliary equipment.

The following shall constitute the type tests for auto-reclosers:

- Tests to prove mechanical operations test (see 8.1);
- Tests to prove that the temperature rise of any part does not exceed specified limits (see 8.2);
- Tests to prove that the insulation complies with specified limit (see 8.3);
- Rated short circuit make and break performance (see 8.4);
- Tests to prove rated duration of short circuit current (see 8.5);
- Performance characteristic test (see 8.6);
- Time-current characteristic tests (see 8.7); and
- Control unit surge withstand test (see 8.8).

The results of all type tests shall be recorded in type test reports containing sufficient data to prove compliance with this specification, and information shall be included so that the essential details of the circuit-breaker tested can be identified.

In principle the individual type tests shall be made on a circuit-breaker in a new and clean condition, and the various type tests may be made at different times and at different locations.

8.1 Tests to Prove Mechanical Performance

8.1.1 Unless otherwise specified, the mechanical operations test shall be made at the ambient air temperature of the test location. The supply voltage of the operating devices shall be maintained at the terminals with full current flowing. Equipment forming integral part of the operating devices shall be included. All groundable parts of the auto-recloser and control apparatus where used, shall be grounded in a manner not to decrease the withstand voltage.

All groundable parts of the auto-recloser and control apparatus where used, shall be grounded in a manner not to decrease the withstand voltage.

8.1.2 The mechanical test shall consist of 2 000 unit operations (one opening operation followed by a closing operation) without current or voltage in the main circuit. The

auto-recloser shall be adjusted for the maximum permissible number of unit operations to lockout. If the reclosing times are adjustable, these shall be set for the minimum reclosing times for which the auto-recloser is designed.

8.1.3 During the test, lubrication in accordance with the manufacturer's instruction but no mechanical adjustment is permissible. After the test, all parts, including contacts shall be in good condition and shall not show undue wear.

8.1.4 Any permanent distortion of the mechanical parts that may occur shall not adversely affect the operation of the auto-recloser nor prevent the proper fit of any replacement parts.

8.2 Tests to prove that the temperature rise of any part does not exceed specified limits.

The provisions of IS 13118 : 1991 shall apply.

8.3 Test to Prove that the Insulation Complies with the Specified Limits

The provisions of IS 13118 : 1991 shall apply but the insulation levels shall be as specified in Table 1 of this standard.

8.4 Tests to Prove Short-Circuit Making and Breaking Performance

This shall be done as per the performance characteristic test indicated in 8.6 with the auto-recloser being subjected to the rated operating sequence specified in 5.11.2 with its control unit. If the reclosing intervals are adjustable, these shall be set for the minimum reclosing time for which the auto-recloser is designed. The test shall provide proof of the ability of the recloser to close and latch on the rated making current. These tests will be generally based on IS 13118 : 1991 as applicable.

8.5 Tests to Prove Rated Duration of Short-Circuit

The provision of IS 13118 : 1991 shall apply.

8.6 Performance Characteristic Test

8.6.1 Test Conditions

8.6.1.1 Performance Characteristic Test

This test shall consist of the total number of unit operations as given in col 10 of Table 3 and as apportioned in col 5, 7 and 9 of Table 3 without maintenance during the test. For the operations required in col 9 of Table 3, at least one fast opening followed by one time-delayed opening shall be at current not less than rated symmetrical interrupting current. The recloser shall be adjusted to give the maximum permissible number of unit operations, including at least one fast and time-delayed opening before the lockout operation occurs. If the reclosing intervals are adjustable, these shall be set for the minimum reclosing intervals for which the recloser is designed. The X/R ratio of the

circuit shall not be less than that given in col 4, 6 or 8 of Table 3.

8.6.1.2 The normal frequency recovery voltage shall not fall below the nominal system voltages and shall be held for one second after final interruption. The oscillograph record showing all pertinent information may be discontinued 100 ms after the final interruption.

8.6.2 Test Procedure

8.6.2.1 Power shall be applied to the recloser when in the closed position and then the recloser shall open and reclose until the lockout position is reached. This series of operations shall be repeated a sufficient number of times to obtain the number of unit operations specified in col 5, 7 and 9 of Table 3.

8.6.2.2 Power initiation for each operating sequence to lockout shall be timed to produce maximum offset in the first loop of current with random timing permissible on subsequent closings of each series. Oscillograph records shall be obtained for each operating sequence. The initial loop of current of each operating sequence shall show maximum off-set within a limit of + 0 and - 10 percent. The current for all unit operations shall be within the range specified in Table 3. Current shall be measured at the instant of contact separation for each unit operation.

8.6.3 Condition of Recloser following Performance Characteristic Tests

At the end of the standard operating duty tests, the recloser shall be in the following conditions:

- a) *Mechanical* — The recloser shall be substantially in the same mechanical condition at the beginning. The recloser shall be capable of automatic and manual operation.
- b) *Electrical* — The recloser shall be capable of withstanding rated voltage in the open position, and of carrying rated continuous current at the closed position, but not necessarily without exceeding rated temperature rise.

8.6.4 After the standard operating duty tests, it is not to be inferred that the reclosers can meet its interrupting rating without inspection and maintenance.

8.7 Time Current Characteristic Tests

8.7.1 Test Condition

The time-current characteristic test condition shall be as specified below:

- a) The recloser shall be new and in good condition and tests shall be applied before the device is put into use.

- b) The frequency of the supply voltage shall be $50 \text{ Hz} \pm 5 \text{ percent}$. A sine wave of acceptable commercial standards shall be applied.

The current range for which data shall be from the minimum tripping current to the rated short circuit breaking current.

8.7.2 Test Procedure

Time current tests shall be conducted as described below in 8.7.2.1 to 8.7.2.3.

8.7.2.1 Contact parting time current tests (see Fig. 1)

Contact parting time-current tests shall be made at any voltage up to the rated voltage of the auto-recloser being tested with the test circuit so arranged that current through the recloser is held essentially at a constant value.

8.7.2.2 Clearing time-current data

Clearing time-current data shall be determined by either method A or B.

- a) *Method A* — Adding maximum arcing time to the contact parting time obtained in 8.7.2.1. Arcing time may be obtained from Oscillograms taken in short-circuit breaking or operating duty tests.
- b) *Method B* — Measuring the total clearing time from oscillograms of short circuit breaking tests taken at rated voltage and at currents ranging from minimum trip to rated short circuit breaking rating.

8.7.2.3 Measurement of current during time-current tests

The measurement of current through the auto-recloser during a time-current test shall be made as follows:

- a) A current existing for 1 s or more may be measured with a standard indicating ammeter.
NOTE — A standard ammeter equipped with an adjustable stop to reduce the movement of the needle during test will improve the accuracy of the measurement.
- b) A current of less than 1 s duration shall be measured with an oscillograph or other suitable instrument and the current wave including the dc component of current and the alternating current decrement shall be corrected to steady state conditions for plotting the time curves.

8.7.2.4 Measurement of time during time current tests

The measurement of time shall be made as follows:

- a) A time longer than 10 s may be measured with a stop watch, electric clock, timer or equivalent.

- b) A time between 1 and 10 s may be measured with a synchronous timer or equivalent.

- c) A time shorter than 1 s shall be measured with an oscillograph or other suitable instrument.

8.7.3 Presentation of Data Standard Time-Current Curves

The results of time current tests shall be presented as time current curves on log paper. The curves shall show:

- a) The clearing time for each instantaneous or fast and time delayed time current curve.
- b) The voltage at which the tests are made when plotted on the basis of method B in 8.7.2.2.
- c) The type and rating of recloser for which curve data apply.
- d) The current range from minimum pick-up current to the rated breaking current.
- e) Tolerances:
 - i) Instantaneous or fast clearing time-current curves, or both, for reclosers shall be plotted to maximum test values.
 - ii) Time delay clearing time-current curves for all reclosers shall be plotted to average test values. Permissible tolerance from curves are $\pm 10 \text{ percent}$ of time or current, whichever is greater.

8.8 Control Unit Surge Withstand Capability Tests

Control unit supplied with shunt trip reclosers shall withstand without damage, voltage surges originating in the low voltage energy source, in the current or voltage or both transformers connected to the control unit, or in the control leads connecting the recloser and the control elements. Either of the tests in 8.8.1 and 8.8.2 are to demonstrate this capability.

8.8.1 Oscillatory Surge Tests

The test wave for this test shall be oscillatory, with a frequency of 1.0 MHz to 1.5 MHz, a crest value of 2.5 kV to 3.0 kV occurring in the first half cycle, decaying to 50 percent of the crest value of the first peak in not less than 6 μs . The source impedance of the surge generator used to produce the test wave shall be 150 ohms.

NOTES

1 All voltage and time values refer to the open circuit condition of the surge generator.

2 Time period and repetition rate have been chosen to cover equipment which is used on 50 Hz as well as 60 Hz systems.

8.8.1.1 Test Procedure

The test wave shall be applied to those control unit terminals used to connect the control unit to all instrument transformers, sources of energy, and any other connected element external to the control cabinet, and shall be applied between each pair of terminals and between each terminal and ground. During these tests, the recloser and control elements shall be connected for normal operation and shall be energized at rated voltage of the control unit.

8.8.2 Simulated Surge Arrester

This test simulates a surge arrester operation and the resulting voltage changes that appear on the recloser and control unit due to the rate of current change and the impedance of the ground connection.

8.8.2.1 Test Procedure

A gap connected from one source bushing terminals to the recloser ground lead shall be used to simulate a surge arrester [see Fig. 2(a)]. The gap shall be set to flashover at 80 percent (± 10 percent) of the rated impulse withstand voltage of the recloser on which the control element is to be applied. The surge voltage shall rise to flashover in $1.2 \mu\text{s} \pm 0.5 \mu\text{s}$. The external surge generator current limiting resistance shall be chosen in order to provide a surge current following the gap flashover, having a peak value of $7\,000 \text{ A} \pm 10$ percent.

The recloser ground lead shall be 6 m of 2.05 mm dia copper wire. The control cable shall be of equal length and spaced 150 mm from and run parallel to the recloser ground lead.

Fifteen positive and fifteen negative surges shall be applied to the source bushing with the recloser open. Fifteen positive and fifteen negative surges shall be applied to the load bushing with the recloser closed.

The above tests shall also be applied to a properly rated transformer connected as shown in Fig. 2(b). Fifteen positive and fifteen negative surge shall be applied.

8.8.3 Condition of Control Unit During and After Test

The control unit shall not cause the recloser to open or close during the application of surges.

Following the tests, the recloser and control unit shall be capable of performing all of its normal functions without impairment.

9 ROUTINE TESTS AND ACCEPTANCE TESTS

9.0 The tests described below are for the purpose of revealing faults in material or construction.

They do not impair the properties and reliability of a test object. These tests are routine test and shall be done on all units. These tests are also acceptance tests and shall be carried out for the purposes of acceptance on a number of samples to be agreed upon between the manufacturer and the user.

9.1 Power Frequency Voltage Dry Tests on the Main Circuit

The test shall be as per provisions of IS 13118 : 1991 with test voltage values as per Table 1 of this standard.

9.2 Voltage Tests on Control and Auxiliary Circuit

This shall be carried out under conditions specified in IS 13118 : 1991.

9.3 Measurement of Resistance of the Main Circuit

The provision of IS 13118 : 1991 shall apply.

9.4 Mechanical Operation Tests

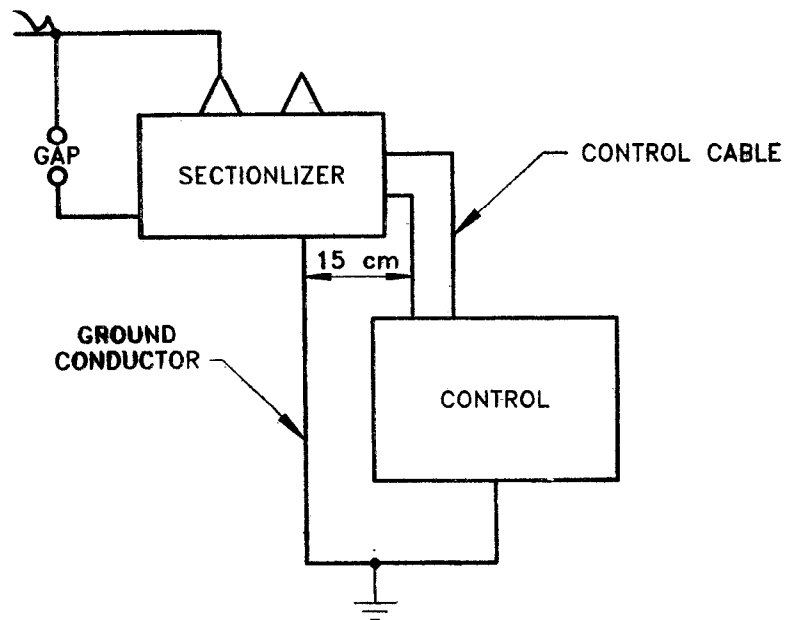
The mechanical operation tests shall include the following:

- a) Without trouble of malfunction, 25 consecutive unit operations to check performance of a mechanism sequencing and time devices.
- b) Five closing and opening operations at rated supply voltage.
- c) Manual tripping by the tripping lever.
- d) Inspection of the external parts.

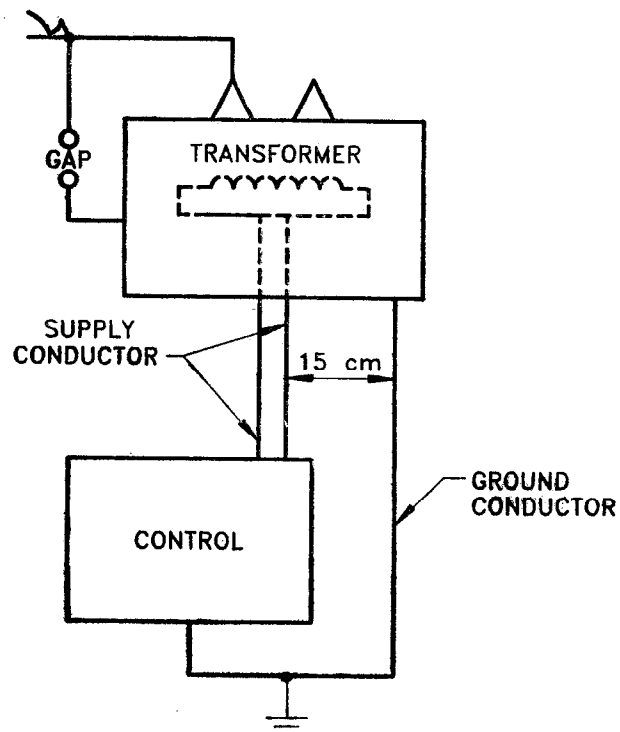
9.5 Calibration Tests

Recloser shall be subjected to the following calibration, where applicable, for conformance to published time-current characteristic curves. Calibration may be performed on the individual control elements sub-assembly prior to final assembly on the recloser. When the latter is done, the effect of the operating time on the recloser shall be recognized, and the complete assembly shall be tested to assure that the device will trip the recloser. Sinusoidal wave shape, 50 Hz current at a convenient voltage shall be used. The calibration may be performed in any order deemed appropriate by the manufacturer:

- a) Trip settings;
- b) Time current characteristic tests;
- c) Sequencing tests;
- d) Remote features; and
- e) Special features.



2 (a) Control Unit with Recloser



2 (b) Control Element with Transformer

FIG. 2 SURGE WITHSTAND TEST CIRCUITS — CONTROL UNIT

Standard Mark

The use of the Standard Mark is governed by the provisions of the *Bureau of Indian Standards Act, 1986* and the Rules and Regulations made thereunder. The Standard Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well defined system of inspection, testing and quality control which is devised and supervised by BIS and operated by the producer. Standard marked products are also continuously checked by BIS for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

Bureau of Indian Standards

BIS is a statutory institution established under the *Bureau of Indian Standards Act, 1986* to promote harmonious development of the activities of standardization, marking and quality certification of goods and attending to connected matters in the country.

Copyright

BIS has the copyright of all its publications. No part of these publications may be reproduced in any form without the prior permission in writing of BIS. This does not preclude the free use, in the course of implementing the standard, of necessary details, such as symbols and sizes, type or grade designations. Enquiries relating to copyright be addressed to the Director (Publications), BIS.

Review of Indian Standards

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of 'BIS Handbook' and 'Standards Monthly Additions'.

This Indian Standard has been developed from Doc No. ETD 08 (3154).

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

BUREAU OF INDIAN STANDARDS

Headquarters:

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110002
Telephones : 331 01 31, 331 13 75

Telegrams : Manaksanstha
(Common to all offices)

Regional Offices :

Central : Manak Bhavan, 9 Bahadur Shah Zafar Marg
NEW DELHI 110002

Telephone

{ 331 01 31
{ 331 13 75

Eastern : 1/14 C. I. T. Scheme VII M, V. I. P. Road, Maniktola
CALCUTTA 700054

{ 37 84 99, 37 85 61
{ 37 86 26, 37 86 62

Northern : SCO 445-446, Sector 35-C, CHANDIGARH 160036

{ 53 38 43, 53 16 40
{ 53 23 84

Southern : C. I. T. Campus, IV Cross Road, MADRAS 600113

{ 235 02 16, 235 04 42
{ 235 15 19, 235 23 15

Western : Manakalaya, E9 MIDC, Marol, Andheri (East)
BOMBAY 400093

{ 632 92 95, 632 78 58
{ 632 78 91, 632 78 92

Branches : AHMADABAD. BANGALORE. BHOPAL. BHUBANESHWAR.
COIMBATORE. FARIDABAD. GHAZIABAD. GUWAHATI. HYDERABAD.
JAIPUR. KANPUR. LUCKNOW. PATNA. THIRUVANANTHAPURAM.